Patent Claims

1. Method for imaging a mask (1) on a substrate (2), whereby said mask (1) is imaged on said (substrate (2) by means of an illumination unit (8) and an optical unit (9),
characterized in that said illumination unit (8) and said optical unit (9) are moved relative to said mask (1) and said substrate (2), in that distortions of said substrate (2) are detected, and in that depending on the detected distortions the image of said mask (1) is distorted and adapted to the distortions of said substrate (2) by means of said optical unit (9).

2. Method in accordance with claim 1, characterized in that the entire image of said mask (1) is composed of in particular overlapping individual images (5), whereby the image field of said optical unit (9) is defined smaller than the entire image, in that said individual images (5) are moved on said substrate (2) by means of active displacing elements (20, 23, 25), in particular of the optical unit, and/or in that by controlling said displacing elements (20, 23, 25) said individual images (5) are combined such that the required distortion of the overall image is attained, whereby each individual image is an undistorted 1:1 image of said mask (1).

3. Method in accordance with claim 1 or 2, characterized in that said distortion of said substrate (2) is calculated by measuring marks (14) of said mask (1) and said substrate (2) or by assigning distortion values and/or in that a combination of measurement values and defined values is performed and/or in that relative positions of marks (14) of said mask (1) to marks (14) of said substrate (2) are determined and/or in that for correction said image is distorted such that said marks (14) of said mask (1) are imaged on said marks (14) of said

substrate (2), whereby said mask (1) and/or said substrate (2) are corrected.

4. Method, in particular in accordance with any of claims 1 through 3, characterized in that the required distortion of the image of said mask (1) and/or an orientation is performed by overlapping or continuous joining of individual images that are smaller then the entire image of said mask (1), whereby said distortions are performed in particular by translation, rotation, shearing, or direction-independent scaling.

5. Method in accordance with any of claims 1 through 4, characterized in that the illumination dots (3) are provided overlapping on said substrate (2) and/or in that the illumination intensity of said illumination dots (3) is softly shielded and/or reduced in its edge zone with respect to its center and/or in that said illumination dot (3) has a Gauss-like distribution of the illumination intensity and/or in that a laser is used for the light source.

6. Method in accordance with any of claims 1 through 5, characterized in that the movement of said illumination dot (3) on said mask (1) is composed of two movements, preferably from one rapid scanning movement of the illumination and one slower movement of a mechanical unit (7) receiving said mask (1) and said substrate (2), and/or in that the correction of said individual image (5) is performed on said substrate (2) corresponding to the position of said illumination dot (3) on said mask (1) and/or in that the combined movement is taken into account for correcting and/or controlling said illumination dot (3).

7. Method in accordance with any of claims 1 through 6, characterized in that the illumination intensity on said mask (1) is controlled by controlling said

illumination source or a controllable damping element and/or in that the illumination intensity is controlled using a pulsed laser by varying the pulse rate and/or in that the illumination intensity is controlled as a function of the position of said illumination dot (3) on said mask (1) and/or in that the illumination intensity is controlled as a function of the speed of said mechanical unit receiving said mask (1) and said substrate (2).

8. Method in accordance with any of claims 1 through 7, characterized in that calibrating the optical path is performed by imaging a reference mark (13) or reference structure by means of an exposure source, in particular the exposure source contained in said illumination unit (8) on an alignment camera (12) that like said mask (1) and said substrate (2) and together with them is arranged on said movable mechanical unit and/or in that realignment of the optical path is performed by means of at least one active element (20, 23, 25), in particular said optical unit (9), and/or in that calibration of the optical measurement devices is performed, in particular by means of an alignment camera (12) and a reference mark (13) that are arranged on said movable mechanical unit (7).

9. Apparatus for imaging a mask (1) on a substrate (2), containing a mechanical unit (7) on which said mask (1) and said substrate (2) are arranged spaced from one another, an illumination unit (8) for creating an illumination dot (3) on said mask (1) and furthermore containing in the optical path between said mask (1) and said substrate (2) an optical unit (9) by means of which said illumination dot (3) can be imaged on said substrate (2), whereby said mechanical unit (7) contains at least one drive (15, 16),
characterized in that said mechanical unit (7) is designed for fixed receiving of said mask (1) and said substrate (2), which fixed receiving cannot change during

the imaging, in that said mechanical unit (7) is movably arranged to said illumination unit (8) and said optical unit (9), which are securely coupled to one another, and in that said optical unit (9) contains at least one active displacing element (20, 23, 25) for displacing said illumination dot (5) on said substrate (2), whereby said displacing element (20, 23, 25) is controllable as a function of distortions of said substrate (2).

10. Apparatus in accordance with claim 9, characterized in that the image field of said optical unit (9) and/or the individual image (5) created by means thereof is smaller than the entire image of said mask (1), whereby the entire image of said mask (1) can be composed of a defined number of the aforesaid individual images (5), and in that a computer system (28) for controlling said active displacing element (20, 23, 25) is embodied such that depending on established distortions and/or corresponding thereto a distortion of the entire image of said mask (1) can be performed by combining the correspondingly deflected individual images (5).

11. Apparatus in accordance with claim 9 or 10, characterized in that said displacing apparatus has a cage (7) that is designed for mutual fixed and spaced arrangement of said mask (1) and said substrate (2), in that said optical unit (9) is arranged in said cage (7) between said mask (1) and said substrate (2), and/or in that said optical unit (9) and said illumination unit (8), which are mechanically coupled to one another, are arranged movable relative to said cage (7), and in that said cage (7) is arranged movable by means of drives (15, 16) relative to said optical unit (9) and said illumination unit (8).

12. Apparatus in accordance with any of claims 9 through 11, characterized in that said optical unit (9) contains imaging optics with two lenses or lens systems

(22) in particular in a 4f arrangement, in that said mask (1) is arranged in the front focal point of the first lens or the first lens system (22) and said substrate (2) is arranged of the second lens or second lens system (22), whereby the ray path is point-mirrored via a retroreflector (25) in front of said first lens or said first lens system (22) or after said second lens or said second lens system (22).

13. Apparatus in accordance with any of claims 9 through 12, characterized in that said optical unit (9) contains a correction unit and/or a displacing element (20, 23, 25), in particular for displacing the image perpendicular to the optical axis in the image plane, and/or in that a plane-parallel plate (20) is provided by means of which the ray bundle is displaceable parallel to the optical axis by tilting perpendicular to the optical axis, and/or in that a mirror (23) is provided that is tiltably arranged perpendicular to the entering and exiting ray bundle, and/or in that a retroreflector (25) is provided that is displaceable perpendicular to the optical axis.

14. Apparatus in accordance with any of claims 9 through 13, characterized in that said retroreflector (25) is movably arranged such that the light path in the imaging optics can be lengthened or shortened and thus the image plane can be imaged precisely on the surface of said substrate (2), whereby the setting of the image plane can be adjusted statically by providing target values or dynamically by positional measurement of the surface of said substrate (2).

15. Apparatus in accordance with any of claims 9 through 14, characterized in that said illumination unit is designed for creating at least two illumination dots (3) on said mask (1), to which a corresponding number of optical units (9) with imaging and correction units are allocated for creating at least two or more

individual images (5) on said substrate (2).

16. Apparatus in accordance with any of claims 9 through 15, characterized in that in particular for simultaneous copying of said mask (1) on one or a plurality of substrates (2) said illumination unit (8) is designed for creating a plurality of illumination dots (3) on said mask (1), and/or in that a beam splitter (37) is arranged in the optical path between said mask (1) and said substrate or substrates (2) such that a plurality of individual images (5) can be created on said substrate or substrates (2) by a plurality of preferably parallel ray paths.

17. Apparatus in accordance with any of claims 9 through 16, characterized by the embodiment for performing said method in accordance with any of claims 1 through 8.